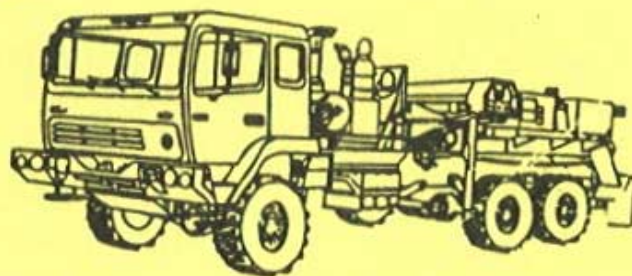
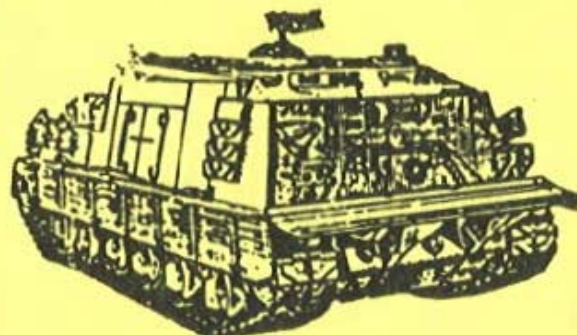




**U.S. ARMY ORDNANCE  
CENTER & SCHOOL  
ABERDEEN PROVING GROUND  
MARYLAND**



**RIGGING CARD**

**FOR  
VEHICLE RECOVERY**

MAY 1996

# **RECOVERY PROCEDURES**

- RECONNOITER AREA . . . . . CHECK TERRAIN FOR BEST  
APPROACH ROUTE AND  
NATURAL ANCHORS.**
- ESTIMATE SITUATION. . . . . DETERMINE RESISTANCE AND  
CAPABILITIES AVAILABLE.**
- CALCULATE . . . . . DETERMINE MECHANICAL  
ADVANTAGE REQUIRED.**
- OBTAIN RESISTANCE. . . . . COMPUTE TOTAL RESISTANCE.**
- VERIFY SOULUTION . . . . . DETERMINE LINE FORCES  
COMPARE WITH LINE CAPABILITIES**
- ERECT RIGGING . . . . . ERECT RIGGING FOR DESIRED  
MECHANICAL ADVANTAGE.**
- RECHECK RIGGING . . . . . ENSURE RIGGING IS READY FOR  
PROPER AND SAFE OPERATION.**
- YOU ARE READY . . . . . MOVE TO SAFE LOCATION: SIGNAL  
OPERATOR TO PAY IN WINCH CABLE  
AND RECOVER LOAD.**

# RECOVERY FUNDAMENTALS

## ESTIMATING LOAD RESISTANCES

	Overturned .....	One-half vehicle weight.
	Nosed (grade) .....	Vehicle weight.
Mired {	Wheel-depth .....	Vehicle weight.
	Fender-depth .....	Double vehicle weight.
	Turret-depth .....	Triple vehicle weight.

## \*LOAD RESISTANCE REDUCTION FACTORS

- 10 Percent—Recovery in the opposite direction from which the mired vehicle was traveling.
- 40 Percent—Applying power to the tracks of the mired vehicle.
- 50 Percent—Combination of recovery in the opposite direction and applying power to the tracks of the mired vehicle.

## LOAD RESISTANCE

Obtained by subtracting reduction factors from the estimated load resistance.

## MECHANICAL ADVANTAGE

Estimate—Load resistance divided by effort available.  
Tackle—Equal to number of lines supporting load.

## TACKLE RESISTANCE

10 percent of load resistance times number of sheaves in the rigging.

## TOTAL RESISTANCE

Load resistance plus tackle resistance.

## LINE FORCES

Fall line—Total resistance divided by mechanical advantage.  
Dead line—Fall line force times number of lines dead line supports.

\*Reduction factors do not apply to wheel vehicles, nosed or overturned tanks.

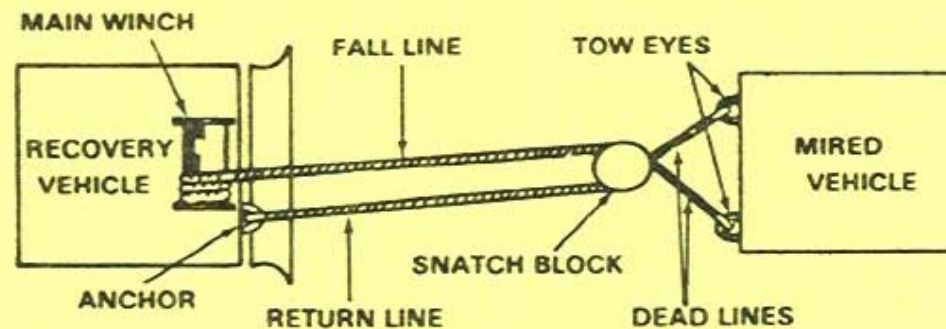


## DETERMINING MECHANICAL ADVANTAGE

$$\frac{\text{TOTAL RESISTANCE (LBS)}}{\text{WINCH CAPACITY (LBS)}} = \text{REQUIRED MECHANICAL ADVANTAGE}$$

### RIGGING EXAMPLE

2 : 1



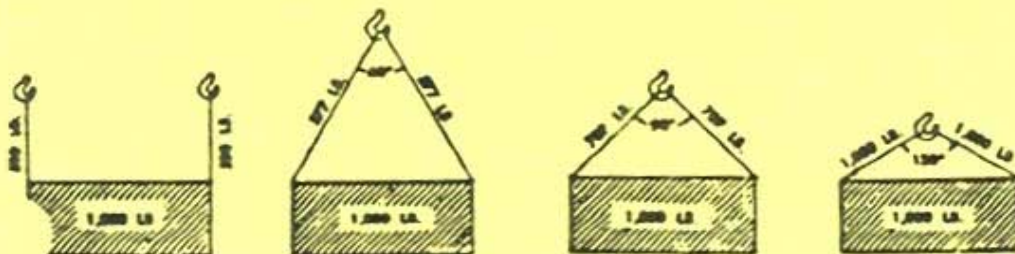
## ROPE AND CHAIN CAPACITIES

DIAMETER (inches)	FIBER ROPE (sisal) $T = 4D^2$ (tons)	WIRE ROPE (IPS) AND CHAIN $T = 40D^2$ (tons)
3/8	.5625	5.625
7/16	.765625	7.65625
1/2	1.	10.
5/8	1.5625	15.625
3/4	2.25	22.5
7/8	3.0625	30.625
1	4.	40.
1-1/8	5.0625	50.625
1-1/4	6.25	62.5
1-1/2	9.0	90.

## SLING LEG FORCES

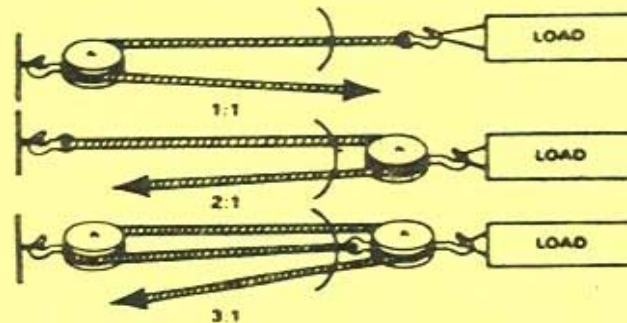
Force per sling leg (2-leg slings) per 1,000 lb. of total resistance.

INCLUDED ANGLE (degrees)	SLING LEG FORCE (pounds)	INCLUDED ANGLE (degrees)	SLING LEG FORCE (pounds)
0	500	90	707
10	502	100	778
20	508	110	872
30	518	120	1,000
40	532	130	1,183
50	552	140	1,462
60	577	150	1,932
70	610	160	2,880
80	653	170	5,734



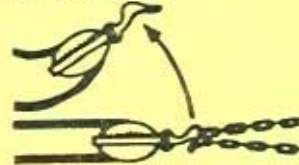
# RIGGING FOR SAFETY

## VARIOUS TACKLE MECHANICAL ADVANTAGES

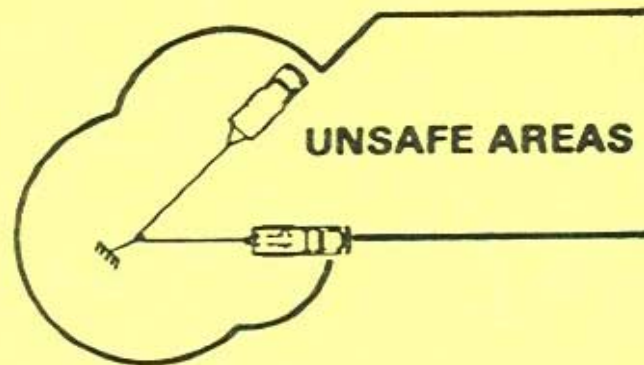


## HOOK POSITION

INCORRECT

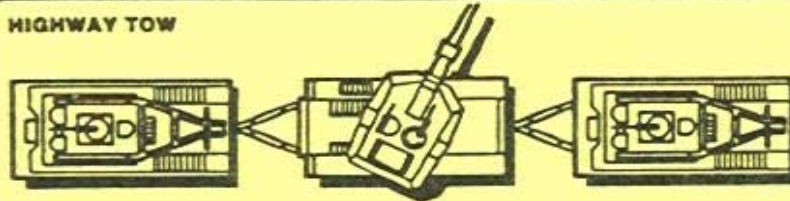


CORRECT

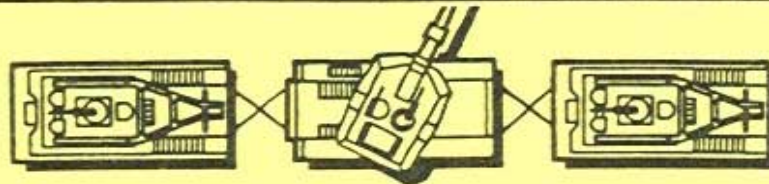


# TOWING METHODS

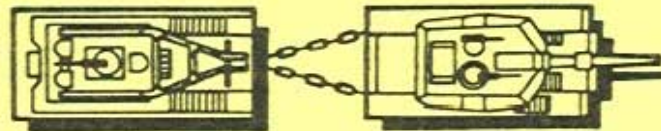
HIGHWAY TOW



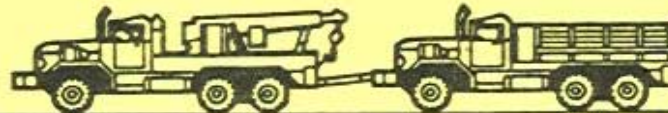
CROSS-COUNTRY TOW



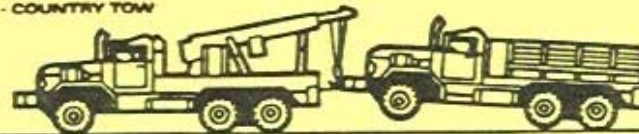
COMBAT TOW



HIGHWAY TOW



CROSS-COUNTRY TOW





## **RECOVERY PRECAUTIONS**

1. WEAR GLOVES WHILE HANDLING CABLES.
2. STEP ON-NOT OVER SLACK CABLES
3. STAND CLEAR OF CABLES UNDER LOAD  
BY LENGTH OF PAID OUT CABLE AND  
OPPOSITE ANGLE OF PULL.
4. BUTTON UP ALL HATCHES DURING WINCH  
PULLS.
5. KEEP RECOVERY VEHICLE EXHAUSTS  
DIRECTED AWAY FROM FUEL SPILLAGE.
6. GROUND GUIDE MUST BE LOCATED  
WHERE ALL VEHICLE OPERATORS CAN  
OBSERVE SIGNALS.
7. INSPECT RIGGINGS FOR SAFE AND  
PROPER ATTACHMENTS BEFORE  
PLACING UNDER LOAD.
8. APPLY POWER TO WINCH CABLE  
GRADUALLY TO REMOVE SLACK IN  
RIGGING.
9. REPORT AND CLEAN UP ALL POL SPILLS.



## RECOVERY TRACKED VEHICLE CAPABILITIES (LBS)



	<u>HOIST WINCH</u>	<u>MAIN WINCH</u>	<u>AUX WINCH</u>	<u>PINTLE TOW</u>
M88A2 RECOVERY VEHICLE	70,000	140,000	6,000	210,000
CABLE SIZE	3/4"	1-3/8"	3/8"	
M578 TRACKED RECOVERY VEHICLE	30,000	60,000		60,000
CABLE SIZE	5/8"	1"		
M88A1 TRACKED RECOVERY VEHICLE	50,000	90,000		112,000
CABLE SIZE	5/8"	1-1/4"		

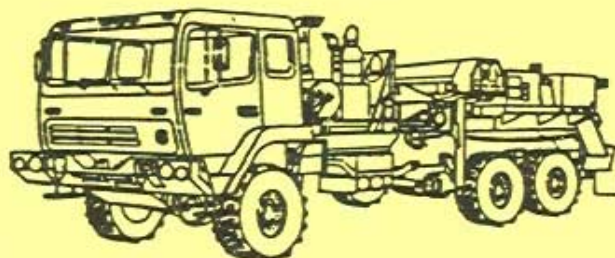


\*WINCH CAPABILITIES ARE FOR BARE DRUM. FULL DRUM  
REDUCES CAPACITY BY APPROXIMATELY 1/2

## RECOVERY WHEELED VEHICLE CAPABILITIES (LBS)



	<u>CRANE WINCH</u>	<u>MAIN WINCH</u>	<u>SELF REC WINCH</u>	<u>PINTLE TOW</u>	<u>LIFT TOW</u>
M543/816/936 5 TON WRECKER	20,000	45,000	20,000	30,000	20,000
CABLE SIZE	1/2"	3/4"	5/8"		
M984A1 HEMTT WRECKER	14,000	60,000	20,000	100,000	25,000
CABLE SIZE	7/16"	1"	9/16"		
M1089 FMTV WRECKER	11,000	30,000	15,500	21,000	20,000
CABLE SIZE	3/8"	3/4"	1/2"		



\*WINCH CAPABILITIES ARE FOR BARE DRUM. FULL DRUM  
REDUCES CAPACITY BY APPROXIMATELY 1/2